DOCUMENT RESUME

ED 447 454 CS 014 151

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TITLE Reading Disability: The Genetics Connection and Appropriate Action.
PUB DATE 2000-07-00
NOTE 6p.; Paper presented at the International Reading Association World Congress on Reading (18th, Auckland, New Zealand, July 11-14, 2000). Based on a talk at the Australian Association for Research in Education Conference (Brisbane, Queensland, Australia, June 1999).
PUB TYPE Information Analyses (070) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Dyslexia; *Early Intervention; Elementary Education; Foreign Countries; *Genetics; Literature Reviews; *Reading Difficulties; Reading Research; *Remedial Reading
IDENTIFIERS Orton Gillingham Tutorial Program

ABSTRACT

This paper presents an overview of recent findings relating to the influence of genetics on reading disability. The paper questions the appropriateness of the etiology of reading disability and its possible relevance to remediation. It finds that early identification of children who are at risk of reading failure due to a genetic cause could help avoid the cycle of failure on entering school and that early intervention programs that incorporate the use of multi-sensory input, such as the Orton Gillingham program, can have beneficial effects. The paper also notes that a history of dyslexia in a family is a risk factor but does not indicate that a child will necessarily be dyslexic. Contains 10 references. (NKA)

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ED 447 454

Reading disability: The genetics connection and appropriate action.

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ABSTRACT
This paper presents an overview of recent findings relating to the influence of genetics on reading disability. The author questions the appropriateness of the etiology of reading disability and its possible relevance to remediation.

There has been ample evidence recently that there is a direct link between genetic factors and cognitive abilities underlying reading ability. Genetic studies have shown that reading difficulties occur more frequently in families where there is a history of reading difficulty than in the general population. Siblings and parents of the reading-disabled children performed significantly worse on reading tests than did siblings and parents of control children (DeFries, Vogler, & LaBuda, 1986). It may be argued that a disorder that runs in families is not necessarily genetic but recent twin studies in Colorado have provided strong evidence for the genetic influence on reading disorders (DeFries, Alarcon, & Olson, 1997).

Whilst these findings may give rise to labelling and all the inherent difficulties which labelling imposes, it is important to acknowledge that there are preventative and remedial programs which can be implemented to assist children who are reading-disabled. Having a genetic risk does not imply that a reading disability is inevitable. The environment may moderate genetic effects. For example, phenylketonuria is a genetic disorder that can lead to severe mental retardation, but restricting the intake of an amino acid called phenylalanine can substantially reduce the effects of this genetic disorder.

It is well known that one of the primary causes of reading disability is poorly developed phonological skills. The genetic studies have gone so far as to offer a phonological deficit as being genetic in origin. If this is indeed the case then we must assume that any intervention, which targets phonological awareness, must benefit the hereditary component of reading disability.

This article is based on Dr Fielding-Barnsley's talk at the AREA conference held in Brisbane in June 1999.

CS 014 151

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INTRODUCTION:

Of all children identified as being learning disabled about 80% will have a reading disorder. The term "reading disorder" may be referred to as 'dyslexia' but in the context of this paper the former terminology will be used. The common characteristics of children with a reading disorder are: reading slowly, poor comprehension, poor oral reading and associated with these, mathematics disorders and poor written expression.

There have been several family studies which have shown that reading disorders tend to run in families (DeFries, Vogler, & La Buda, 1986) but more recently researchers have been able to untangle the shared influence of the environment and genetics in similar family studies. DeFries et al. studied 1044 individuals in 125 families with a reading disabled child and 125 matched control families. The siblings and parents of the reading disabled children performed significantly worse on reading tests than the families of the control children.

The most influential work on unravelling the connections between the influence of the genetic and environmental etiology of specific reading and language skills has been undertaken by a team of researchers in Colorado. The method used is based on studying pairs of twins who are either identical or fraternal. Identical or monozygotic (MZ) twins share all their genes and their home environment (unless separated) whereas fraternal or dyzogotic (DZ) twins only share half of their genes. There is a greater similarity between identical twins than fraternal twins, in fact fraternal twins are no more alike than other siblings. A greater similarity between MZ twins compared to DZ twins provides evidence for a genetic influence.

Genetic influence has been measured for word recognition, reading comprehension and spelling. DeFries and Alarcon (1996) estimated that the heritability of this composite measure was h2g = .56 which means that approximately half of the group deficit is due to genetic factors. Group deficits in phonemic awareness, phonological decoding and orthographic coding have also been conducted (Olson, Forsberg, & Wise, 1994). Phonemic awareness is measured by a task that requires the isolation of single phonemes within spoken words.

An interesting finding in the research to date is that gender does not appear to be related to the degree of genetic influence on reading deficits (DeFries, Gillis, & Wadsworth, 1993). These findings do not shed any light on the findings of Duane, 1991, with reported incidence of reading disorders being as high as four to six times greater in males than in females. There is also evidence for the importance of IQ in the genetic etiology of deficits in word recognition, disabled readers with higher IQ scores have a stronger genetic influence then those with low IQ. (Olson, Forsberg, Gayan, & DeFries, in press). These researchers explain the concurrence of low IQ and low reading to shared family environment that may constrain both reading and general cognitive development. With

high IQ the reading environment may be richer and poor reading may be more prone to genetic influence.

IMPLICATIONS FOR TEACHING

Early identification of children who are risk of reading failure due to a genetic cause could help avoid the cycle of failure on entering school. It is not impossible to remediate the type of problems that these children exhibit. Early intervention programmes that incorporate the use of multi-sensory input such as The Orton Gillingham program, can have beneficial effects. Montessori methods are also useful, I have used the sandpaper alphabet letters with measurable success. I have also used a modified version of The Lindamood programme, which is an effective method in drawing attention to the articulatory actions that, produces each phoneme. Children learn how to use sensory feedback from the eyes, ear and mouth to identify, classify and label phonemes. For example the phonemes /b/ and /p/ are called "lip poppers" because of the articulatory processes involved.

Computer programmes using synthetic and digitised speech have been used successfully by Wise and Olson (1995). These programmes allow children to interact with the reading material. When a child encounters a difficult word they are able to target the word and obtain a spoken response. These programmes are capable of improving the disabled readers' phoneme awareness and phonological decoding.

Strategies to implement phonological awareness in the classroom have been developed by Adams, Foorman, Lundberg & Beeler (1998). This book not only contains activities but supplies lesson plans, screening tests and recommendations for further assessment. Some useful inclusions are bibliographies of rhyming stories and a section of poems, fingerplays, jingles and chants. One particularly novel game emphasises rhyme through movement. Children sit in a circle and chant "One potato, two potato, three potato four" and the child who is "it" taps each child in the circle as each number word is chanted, the child who is tapped to the rhyming word must then put one hand behind their backs. This book is full of fun activities that teach rhyme, awareness of words, syllables and finally phonemes. Another useful book for the classroom is Goldsworthy's (1998) Sourcebook of Phonological Awareness Activities: Children's Classic Literature. This book utilises well-known and accessible tales to promote phonological awareness. The University of Queensland Department of Speech Pathology (1998). Has developed a Phonological Awareness for Literacy Program (PAL) which is also a useful addition to any classroom.

Teaches who are struggling to teach these children should take heart from the fact that achievement is more amenable to intervention than cognitive ability. It has been demonstrated that ability levels as opposed to achievement levels have a higher genetic influence. The Case Western Reserve Twin Project has shown that although achievement

was influenced by both environmental and genetic factors, ability-achievement associations were almost exclusively genetic in origin, and ability-achievement discrepancies were due to environmental influences (Thomson, Detterman, & Plomin, 1991) The underlying genetic factors may be responsible for both ability and achievement but the child's environment will affect whether a discrepancy between ability and achievement occurs.

CONCLUSION

It is also important to note that a history of dyslexia in a family is a risk factor but does not indicate that a child will necessarily be dyslexic
Nevertheless genetic factors play an important role in reading disability, about 30-40% is heritable. However, this fact must not exclude the importance of the environmental contribution. It may be argued that environmental factors are easier to control than genetic factors but future research may reverse this trend. Although genetic engineering highlights what is potentially dangerous to mankind at present it may not always be so. As educators we need to have open minds to the potential benefits of this relatively new science and as Shankweiler (1999) suggests we need to educate the public on the merits of biologically based approaches to reading disability.

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